

NASA TECH BRIEF

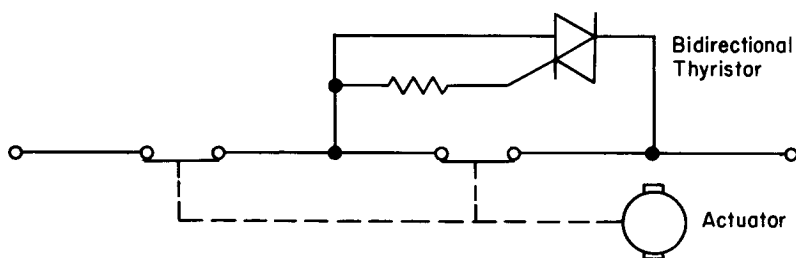
Manned Spacecraft Center



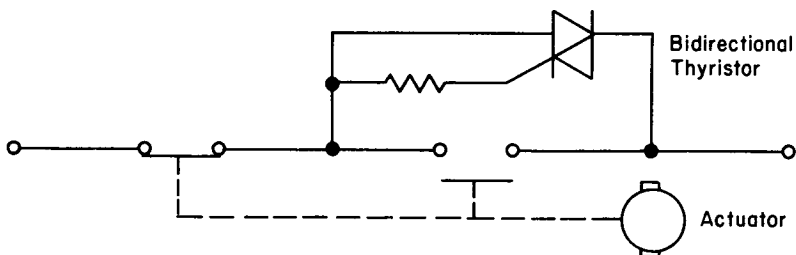
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A Hybrid Electromechanical Solid State Switch For AC Power Control

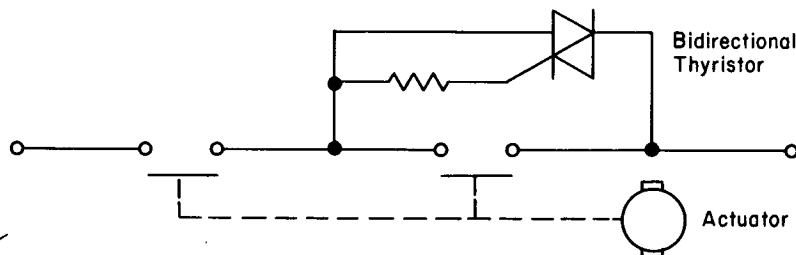
Closed Circuit:



Intermediate Switching Condition:



Open Circuit:



A bidirectional thyristor coupled to a series of actuator driven electromechanical contacts generates a hybrid electromechanical solid state switch for ac power control. This innovation combines the rapid, controllable

switching of a solid state device with the low-loss, high-isolation characteristics of an electromechanical switch.

A solid state zero-crossing detector provides a precisely timed control signal for the thyristor. The

(continued overleaf)

thyristor switches on or off at the zero crossing point. Electromechanical contacts are closed or opened to complete the switching process. No significant arcing takes place; EMI generation, and switching transients are minimized.

The illustration is a simplified diagram of a hybrid approach to the switching problem. In the closed circuit condition (upper diagram), the electromechanical contacts provide circuit continuity from source to load. The thyristor is shunted out of the circuit and has virtually no impact on operational or reliability considerations.

In the open circuit condition (bottom diagram), the thyristor is essentially isolated from the circuit. Physical separation of the load from the source is obtained by electromechanical contacts.

During switching (middle diagram), the thyristor provides the advantages of solid state power control. On circuit break, the electromechanical shunt contact opens first. As it opens, a steady gate signal immediately turns on the thyristor to assume the current load, and no significant arcing takes place across the contacts. The contacts continue to separate for several cycles. Then the thyristor control circuit removes the gate signal, and the thyristor turns off at the next zero current crossing of the ac power. After the thyristor has opened

the circuit, the series contact opens, providing physical circuit separation. The operation is reversed to turn on the circuit.

These characteristics should make this innovation useful in power control applications where zero cross-over switching is required. It should be of interest to designers and manufacturers of power control devices, systems and support equipment.

Notes:

1. A related innovation is described in NASA Tech Brief B67-10165.
2. Requests for further information may be directed to:

Technology Utilization Officer
Manned Spacecraft Center, Code JM7
Houston, Texas 77058
Reference: TSP72-10018

Patent status:

No patent action is contemplated by NASA.

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